BDCP
BAY DELTA CONSERVATION PLAN

Bay Delta Conservation Plan
Statewide Economic Impact Report

ICF International

The Brattle Group

August 8, 2013

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Presentation Overview

- Report presents an analysis of the economic impacts of the BDCP
  - Impacts measured relative to a benchmark scenario (ECHO as defined in Chapter 9)
  - Impacts evaluated over the 50-year permit term
  - Future costs and benefits discounted at a 3% rate

Impact Categories

- Report estimates impacts to Californians in two categories
  - Welfare impacts
    - Construction
    - O&M
    - Habitat restoration
    - Water supply reliability
    - Quality of state and federal deliveries
    - Seismic risk to project deliveries
  - Changes in business output (GDP) and employment

Impact Categories

- Welfare impacts
  - Used in cost benefit analysis
  - Welfare is the standard economic measure of well-being
  - Difference between what an action is worth and what it costs
    - Consumer surplus
    - Profit

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Impact Categories

- Changes in economic activity
  - Business sales
    - State GDP
  - Employment
    - Measured in job-years

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Impacts to Delta-Dependent Economic Activities

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Dr. David Sunding

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Agricultural Salinity Impacts

Crop Category	Crop Category Average. Revenue per Acre[a]	Forecast Acreage		Total Revenue	
		Existing Conveyance High Outflow Scenario	BDCP High Outflow Scenario	Existing Conveyance High Outflow Scenario	BDCP High Outflow Scenario
	[a]	[b]	[c]	[a] * [b]	[a] * [c]
Deciduous	$4,612	12,936	12,896	$59,660,832	$59,476,352
Field	$780	184,438	184,719	$143,861,640	$144,080,820
Grain	$426	47,827	48,083	$20,374,302	$20,483,358
Pasture	$116	22,929	22,956	$2,659,764	$2,662,896
Truck	$3,903	43,310	42,889	$169,038,930	$167,395,767
Vineyard	$3,566	25,860	25,758	$92,216,760	$91,853,028
		Total Revenue		**$487,812,228**	**$485,952,221**
		Scenario Revenue Losses			**-$1,860,007**

[a] The average crop class revenue per acre is based on 2009 yield and price data from county crop reports.

The net present value of these agricultural revenue losses will total $33.9 million at a 3% real discount rate (evaluated for years 2025 through 2075).

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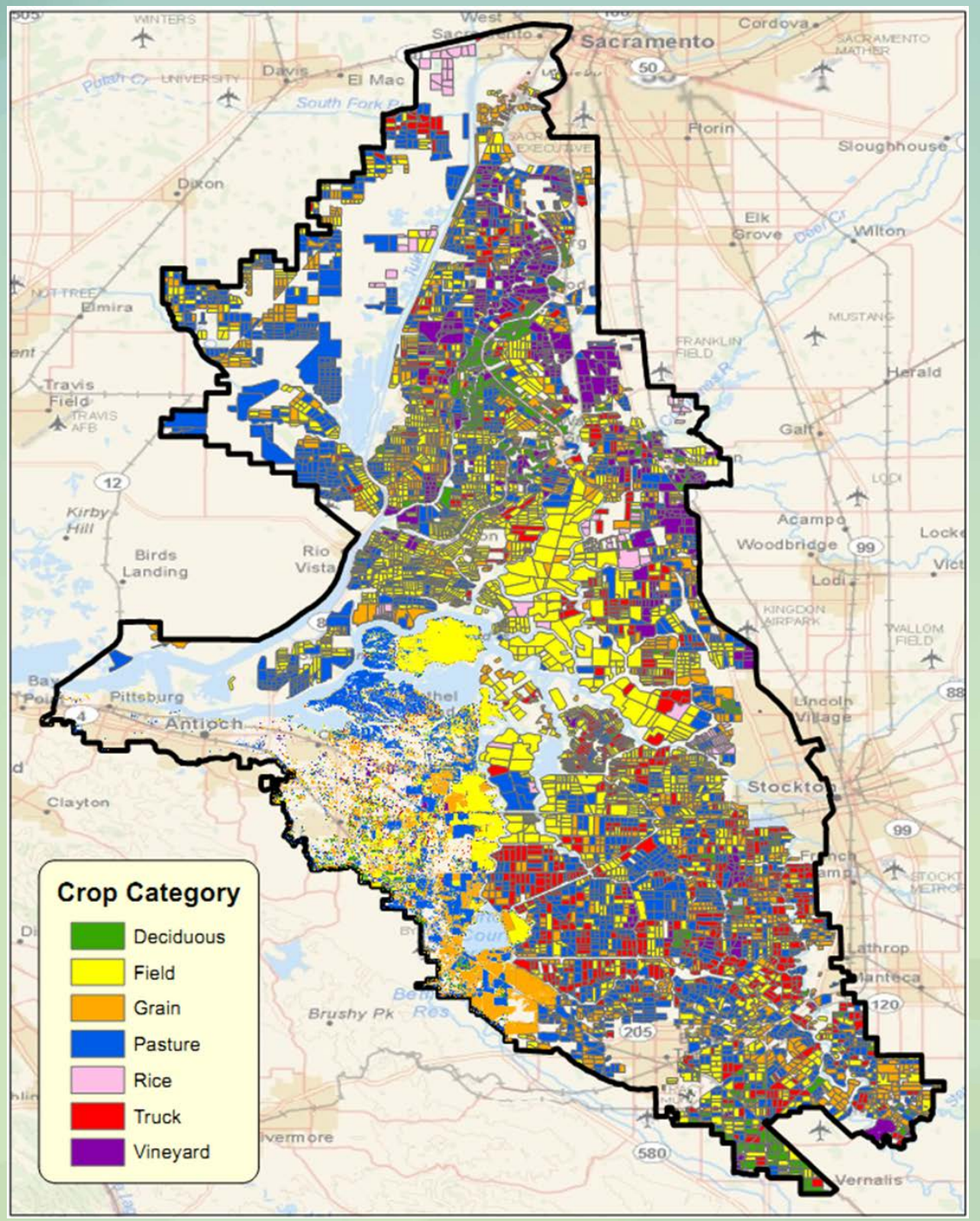
Agricultural Land Cover (2010)



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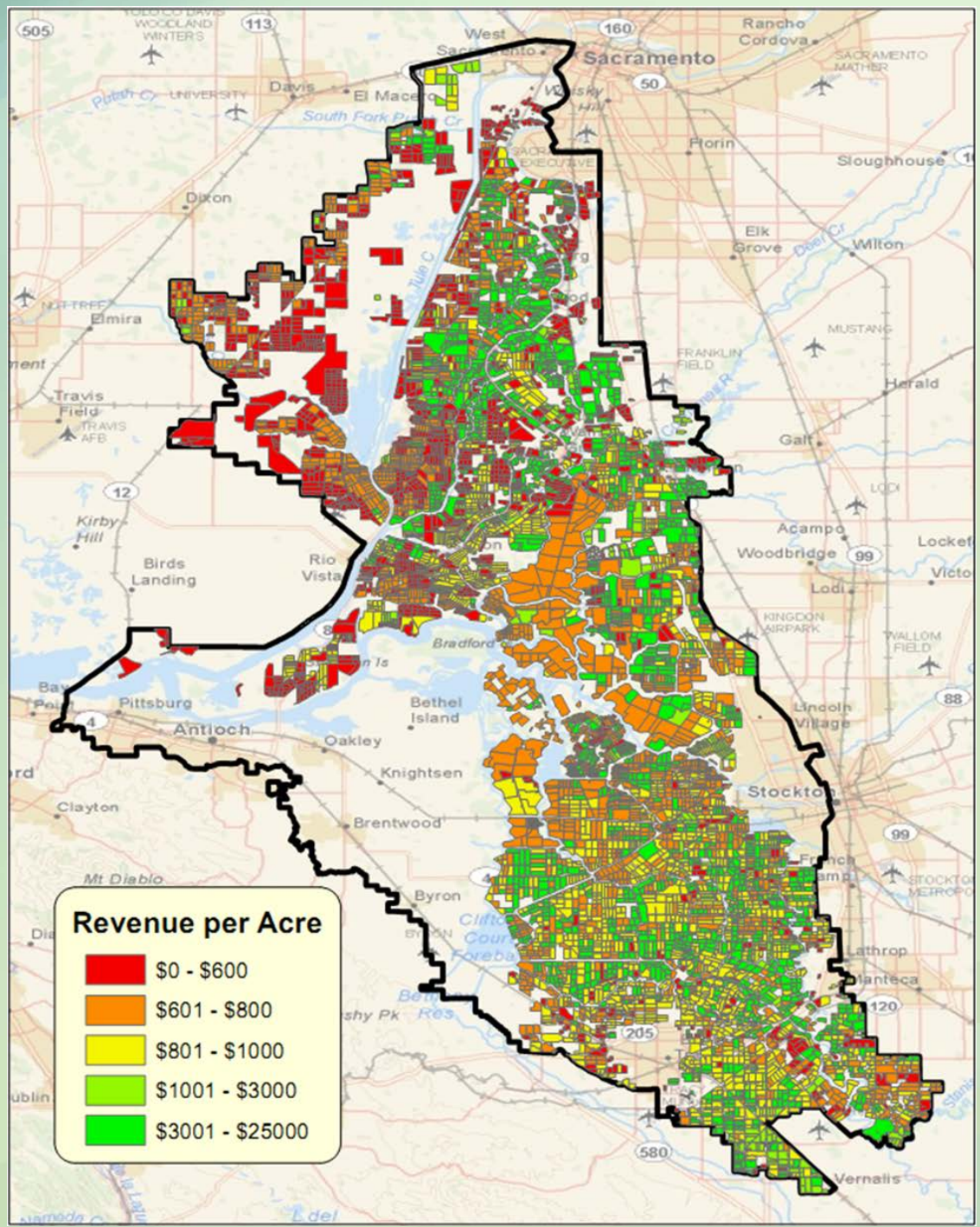
Average Revenue per Acre (2009)



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Overview of Recreation Impacts

- Construction and operation of the Water Conveyance Facility could negatively impact outdoor recreation
  - Some negative impacts will be reduced through mitigation measures
- Conservations measures are expected to enhance and expand outdoor recreation
- Analysis considered impacts on:
  - Nonconsumptive visits, migratory bird–hunting visits, and freshwater angling visits
- EIR/EIS Chapter 15, Recreation

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Quantifying Recreation Impacts

Benefit Transfer Inputs

- Estimated changes in acres of recreation sites
- Population and Income of Residents

Benefit Transfer Toolkit

- Non-consumptive Recreation
- Migratory Bird Hunting
- Freshwater Angling

Benefit Transfer Outputs

- Change in visitor days for each activity

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Monetizing Recreation Impacts

- Changes in visitor days were multiplied by the unit-day value for each recreational activity
  - Represents the value of recreation to participants
  - Used by U.S. Forest Service in cost-benefit analyses

Unit-Day Values for Selected Recreational Activities

Activity	Low Value	Median Value	High Value
Non-consumptive	$29.63	$50.59	$154.95
Migratory Bird Hunting	$27.75	$54.70	$151.92
Freshwater Angling	$2.92	$51.65	$221.63

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Total Impacts of BDCP Related to Recreation

Recreation Opportunity	Discounted Total Value of Change in Recreation (Low Value, Million $) [a]	Discounted Total Value of Change in Recreation (Median Value, Million $)
Nonconsumptive recreation	$223.2	$370.0
Migratory bird hunting	-$1.5	-$3.0
Freshwater angling	$0.2	$3.0
Net Recreation Value	**$221.8**	**$370.0**

[a] All values are discounted at a 3% rate relative to 2015.

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Overview of Transportation Impacts

- Construction of Water Conveyance Facility will cause transportation delays in the Plan Area
  - Projected to affect 114 road segments
- Impacts on transportation from construction of the other conservation measures are expected to be minimal
- EIR/EIS Chapter 19, Transportation

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Quantifying Transportation Impacts

- Projected traffic volumes on affect roadways for baseline and BDCP scenarios
- Estimated average speeds on affected roadways given projected traffic volumes
- Estimated the increased in time on each affected roadway between BDCP and baseline scenarios
- Estimated the total car-hours of delays for construction period

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Monetizing Transportation Impacts

- Total delay hours were multiplied by the per-hour opportunity cost of a traveler's time.
  - Represents value of forgone time spent on other activities due to increased travel time
  - Used by U.S. DOT in regulatory analysis
  - Differs based on the use of the foregone time (i.e., work time or leisure time)

Opportunity Cost of a Traveler's Time (Per-hour, weighted value)

Low Value	High Value
$16.26	$24.40

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Mitigation Strategy for Transportation Impacts

- Mitigation will occur on segments where the Level of Service (LOS) threshold is exceeded
  - 23 segments exceed LOS without construction
  - 10 segments exceed LOS because of construction

- Mitigation measures include:
  - Avoided/reduced circulation effects, notify public, alternative access routes, limit/prohibit construction activity, enhance roadway conditions

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Total Impacts of BDCP Related to Transportation

	Annual Delay (Hours) in Plan Area	Total Discounted Cost ($ Millions) [a] Low Estimate	Total Discounted Cost ($ Millions) High Estimate
Total Construction Impacts [a]	4,997,926	$73.85	$110.77
Construction Impacts on Segments with Decreased LOS	4,985,091	$73.66	$110.49
Avoided Traffic Delays [b] [b]	1,421,677	$21.01	$31.51
Net Construction Impacts [c] = [a] – [b]	3,576,249	$52.84	$79.26

[a] All values are discounted at a 3% rate relative to 2015.
[b] Assumes a 10% reduction in the volume of vehicles on mitigated road segments.

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Impacts Related to Urban Water Treatment

- Water quality impacts results primarily from the water conveyance facility and CM2 - CM11
- Analysis of water quality impacts focused on two key contaminants – bromide and nitrate
  - These contaminants are linked to adverse health impacts, and have mandated thresholds for Delta waterways
- EIR/EIS Chapter 8, Water Quality

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Findings of Urban Water Treatment Impact Analysis

- Analysis examined bromide and nitrate concentrations at four major Delta pumping stations: Baker Slough, Contra Costa, Banks, and Jones Pumping Stations
- Net impact of the BDCP is a decrease in the concentration of both contaminants
- These quantified impacts were not monetized

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Overview of Delta Commercial Fisheries

- Fall-run Chinook salmon is the major commercial fish species affected by BDCP
- Other commercial fisheries include threadfin shad, crayfish, and California bay shrimp
- Other prevalent fish found in the Delta, such as sturgeon and bass, do not have commercial fisheries, but are a main attraction for sports anglers.
- EIR/EIS Chapter 11, Fish and Aquatic Resources

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Impacts on Commercial Fisheries

- Construction and operation of CM1 affects Chinook salmon
  - Positively affects entrainment
  - No effect to spawning habitat
  - Small positive effect to rearing habitat
- Other conservation measures include actions to protect, restore, and enhance natural communities (CM2 through CM22)
  - The effects of restoration activities on Chinook salmon are expected to be beneficial
  - Net increases in available habitat, habitat diversity, overall productivity, and reduced predation

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Finding from Commercial Fisheries Analysis

- The BDCP is expected to increase the survival rates of fall-run Chinook salmon
- BDCP is also expected to positively impact other Delta commercial fisheries, such as threadfin shad, crayfish, and California bay shrimp
- This study was not able to quantify and monetize the impacts of the BDCP related to commercial fisheries due to high levels of uncertainty in projecting fish populations

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Impacts to Delta-Dependent Economic Activities

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Overview of Air Quality Impacts

- Impacts of the BDCP on regional air quality result from:
  - Construction and operation of the Water Conveyance Facility (CM1)
  - Conservation measures
- Construction and operation of CM1 results in increased emissions of criteria air pollutants
- Conservation measures to protect, restore, and enhance natural communities will improve air quality, but to an uncertain degree
- EIR/EIS Chapter 22, Air Quality and Greenhouse Gasses

Quantifying Air Quality Impacts

- Analysis considered six criteria pollutants:
  - Reactive Organic Gases; Nitrogen Oxides; Carbon monoxide; Particulate matter less than 10 micrometers in diameter; Particulate matter less than 2.5 micrometers in diameter; Sulfur Oxide
- Used the California Emissions Estimator Model to estimate air pollutant emissions from construction and operation CM1
- Quantified emission for three regions:
  - San Francisco Bay Area Air Basin, Sacramento Federal Nonattainment Area, and San Joaquin Valley Air Basin

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Monetizing Air Quality Impacts

- Per-ton emissions of each pollutant were multiplied by their per-ton health costs.
  - Represent the cost of increased mortality and morbidity that can be linked to air pollutants

Health Costs for Air Pollutants (2016 Per-Ton Value)

Pollutant	Low Value	High Value
ROG	$247	$1,997
NO_x	$1,527	$12,922
PM10	$2,328	$9,465
PM2.5	$79,884	$669,618
SO_x	$9.389	$79,884

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Mitigation Strategy for Air Quality Impacts

	NOx Offsets	ROG Offsets
Annual Offsets	Sacramento Metropolitan and San Joaquin Valley AQMD	None
Daily Offsets	Bay Area and the Sacramento Metropolitan AQMD	Bay Area AQMD

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Total Impacts of BDCP Related to Air Quality

Cost Component		Total Discounted Cost ($ Millions) [a] Low Estimate	Total Discounted Cost ($ Millions) High Estimate
Total costs of pollutant emissions from construction	[a]	$1.55	$13.05
Total avoided heath costs due to mitigation	[b]	$0.91	$7.91
Total pollution mitigation offset costs	[c]	$10.14	$10.14
Total costs of pollutant emissions from operations	[d]	$0.01	$0.04
Total Economic Impact	[a] –[b] + [c] + [d]	$10.80	$15.56

[a] All values are discounted at a 3% rate relative to 2015.

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Greenhouse Gas Emissions

Overview of Impacts

- Primary GHGs from construction and operation of CM1
- Quantitative analysis of direct GHGs
  - Regulatory costs driven by mitigation pursuant to CEQA and NEPA
  - Community co-benefits that supplement expected GHG reductions
- Qualitative and quantitative analysis of indirect GHGs
  - Regulatory costs based on cap and trade system or carbon tax
  - Community costs based on the social cost of carbon
- EIR/EIS Chapter 22, Air Quality and Greenhouse Gasses

Construction

O&M

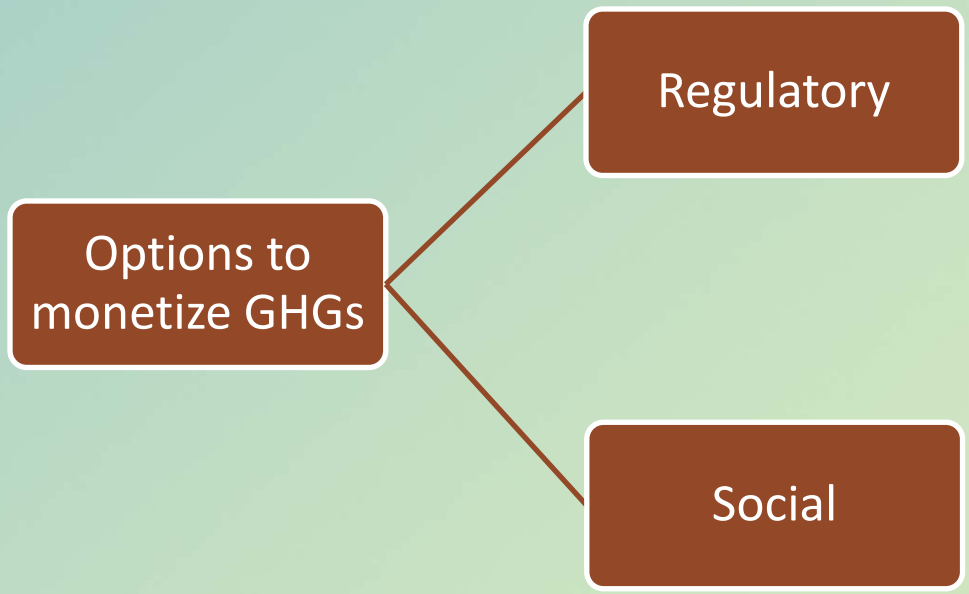
Electricity

Materials

Land Conversion

Greenhouse Gas Emissions

Monetizing GHG emissions



Penalties for emissions generation and incentives for emissions reduction

→ *Example: California Cap and Trade; CEQA mitigation*

Community costs for damages due to climate change resulting from GHG emissions

→ *Example: Public health costs from deteriorating air quality*

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Greenhouse Gas Emissions

Methods to Quantify Direct Economic Impacts

Mitigation	Description	Potential Costs	Method
AQ-15	Develop a mitigation program to offset construction GHGs	Upfront costs to purchase reduction technologies	Quantified $/metric ton, $/unit, total cost
AQ-19	Prepare a land use sequestration analysis for CM2-CM11	Consultant time to prepare the study	Estimated labor costs based on professional practice
DWR REPP*	Modify DWR's REPP to accommodate operational GHGs	Added cost of renewable over conventional energy	Obtained marginal cost data from DWR

**Renewable Energy Procurement Plan*

Greenhouse Gas Emissions

Methods to Evaluate Indirect Economic Impacts

Source	Potential Costs	Method
Electricity Demand	Upfront costs to procure new generators Increased costs under CA Cap and Trade Increased electricity rates	Qualitative
Materials	Increased costs under CA Cap and Trade Increased cement prices	Qualitative
Land Conversion	Reduced community cost from climate change moderation from reduced GHGs	High-level estimate of social costs from changes in GHG flux

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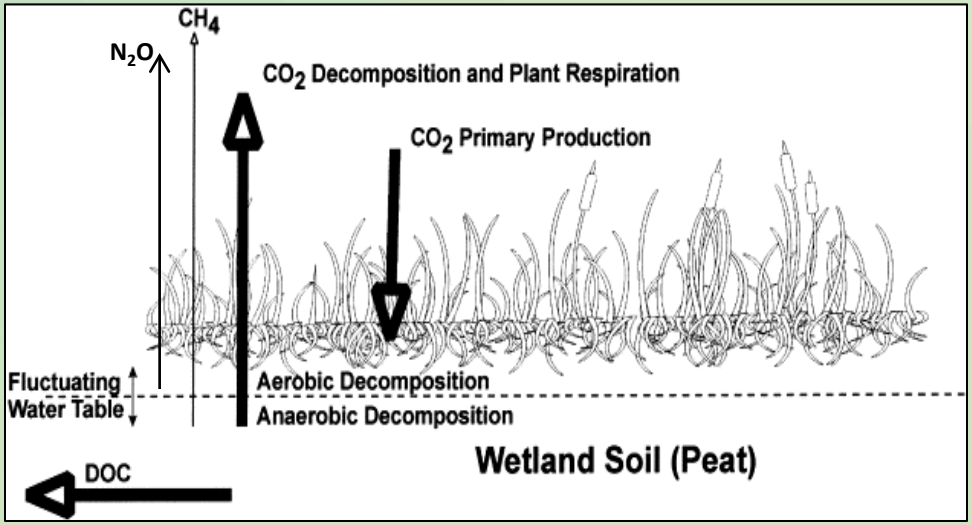
Greenhouse Gas Emissions

Methods to Evaluate Indirect Economic Impacts

Land Conversion

GHG Flux Depends on

- Temperature and PH
- Presence of water
- Location of water table
- Available soil nitrogen
- Salinity
- Amount of dead material
- Age of wetland
- Organic material quality and quantity
- Prevailing climate
- Species present
- Stem density



Fluxes IN/OUT highly variable in space and time

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Greenhouse Gas Emissions

Summary of Results

Economic Costs

AQ-15	$4.6 to $159.3 million
AQ-19	$141,000 to $189,000
DWR' REEP	$77,600,000
Total	**$82.3 to $237 million**

Economic Savings

Community Co-Benefits	Financial, environmental, and public health benefits
Climate Change Moderation	$3 to $69 million per year

Net benefits range from -$47.0 million to $478.7 million

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Impacts Related to Flood Risk

- Flood risk impacts would result from the water conveyance facility operation and various conservation measures
- Impacts expected to be both positive and negative, and thus small in total
- Impacts were considered qualitatively
- EIR/EIS Chapter 5, Water Supply; EIR/EIS Chapter 6, Surface Water

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Impacts Related to Property Values and Viewscapes

- Analysis focused on potential impacts on property values not estimated elsewhere – changes in viewscapes and noise levels
- Water conveyance facility is expected to have a negative impact on nearby properties
  - Several mitigation measures would be implemented to reduce these impacts
- EIR/EIS Chapter 17, Aesthetics and Visual Resources; EIR/EIS Chapter 23, Noise

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Impacts Related to Property Values and Viewscapes (Continued)

- Other conservation measures are expected to have a positive impact on nearby properties
- Conducted a literature review of studies estimating similar kinds of property value impacts
- Property value impacts considered only qualitatively, but expected to be relatively small in total

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Impacts Related to Erosion and Sedimentation

- The water conveyance facility operation and various conservation measures would affect erosion and sedimentation rates
- Impacts expected to be both positive and negative
- Impacts related to erosion and sedimentation considered qualitatively
- EIR/EIS Chapter 10, Soils

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Summary of Benefit Cost Analysis of the BDCP

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Summary of Welfare Impacts

	Present Value Costs	Present Value Benefits	Present Value Net Benefits	Present Value Costs	Present Value Benefits	Present Value Net Benefits
	Low Value			High Value		
	A	B	C = A + B	D	E	F = D + E
State and Federal Water Contractors						
State and federal water contractors	-$13,328	$18,011	$4,683	-$13,328	$18,011	$4,683
Impacts on Delta-Dependent Economic Activities						
Salinity of agricultural water suppliers	-$34	$0	-$34	-$34	$0	-$34
Outdoor recreation	-$2	$223	$222	-$3	$373	$370
Transportation delays	-$53	$0	-$53	-$79	$0	-$79
Subtotal	**-$88**	**$223**	**$135**	**-$117**	**$373**	**$257**
Impacts on Non-Market Environmental Amenities						
Air quality	-$11	$0	-$11	-$16	$0	-$16
Greenhouse gas emissions	-$82	$35	-$47	-$237	$715	$479
Subtotal	**-$93**	**$35**	**-$58**	**-$252**	**$715**	**$463**
Total Welfare Impact	**-$13,509**	**$18,270**	**$4,761**	**-$13,696**	**$19,099**	**$5,403**

Note: Employment impacts are not show in this table, because the value added is through full-time equivalents, not dollars.

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Changes in Statewide Income and Employment

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Output Impacts

Category	Years 1–10	Years 10–20	Years 20–30	Years 30–40	Years 40–50	Total over 50 Years
CM1 Water Facilities and Operation						
Construction and planning	$21,238	$0	$0	$0	$0	$21,238
Operations and maintenance	$0	$474	$353	$263	$195	$1,285
Total	**$21,238**	**$474**	**$353**	**$263**	**$195**	**$22,523**
Other Relevant Conservation Measures (CM2–CM11, CM13–CM21)						
Construction and planning	$2,486	$1,318	$987	$690	$132	$5,612
Operations and maintenance	$497	$529	$364	$282	$217	$1,890
Land acquisition[b]	$319	$197	$137	$102	$0	$755
Other[c]	$342	$298	$204	$156	$103	$1,103
Agricultural land retirement[d]	($319)	($584)	($672)	($677)	($539)	($2,791)
Total	**$3,325**	**$1,757**	**$1,020**	**$553**	**($87)**	**$6,569**
Water Supply Reliability						
Commercial/ industrial/ institutional	$0	$24,919	$18,542	$13,797	$10,266	$67,525
Agricultural	$0	$2,181	$1,623	$1,208	$899	$5,910
Total	**$0**	**$27,100**	**$20,165**	**$15,005**	**$11,165**	**$73,435**
Increased Water Rates and Taxes						
Induced Output Impact	($16,327)	($925)	($777)	($580)	($411)	($19,019)
Total	**($16,327)**	**($925)**	**($777)**	**($580)**	**($411)**	**($19,019)**
Total Economic Impacts Across All Categories	**$8,236**	**$28,407**	**$20,761**	**$15,241**	**$10,863**	**$83,508**

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Employment Impacts

Category	Years 1–10	Years 10–20	Years 20–30	Years 30–40	Years 40–50	Total over 50 Years
CM1 Water Facilities and Operation						
Construction and planning	110,596	0	0	0	0	110,596
Operations and maintenance	0	2,833	2,833	2,833	2,833	11,331
Total	**110,596**	**2,833**	**2,833**	**2,833**	**2,833**	**121,928**
Other Relevant Conservation Measures (CM2–CM11, CM13–CM21)						
Construction and planning	15,962	11,338	11,414	10,733	2,753	52,200
Operations and maintenance	3,494	4,909	4,539	4,727	4,879	22,548
Land acquisition[b]	2,016	1,676	1,580	1,572	0	6,844
Other[c]	2,070	2,400	2,219	2,280	2,028	10,998
Agricultural land retirement[d]	(2,092)	(5,076)	(7,824)	(10,569)	(11,258)	(36,819)
Total	**21,450**	**15,247**	**11,928**	**8,743**	**(1,598)**	**55,770**
Water Supply Reliability						
Commercial/ industrial/ institutional	0	190,460	190,460	190,460	190,460	761,840
Agricultural	0	64,456	64,456	64,456	64,456	257,824
Total	**0**	**254,916**	**254,916**	**254,916**	**254,916**	**1,019,664**
Increased Water Rates and Taxes						
Induced Employment Impact	(88,322)	(5,004)	(4,202)	(3,137)	(2,221)	(102,885)
Total	**(88,322)**	**(5,004)**	**(4,202)**	**(3,137)**	**(2,221)**	**(102,885)**
Total Employment Impacts Across All Categories	**43,725**	**267,992**	**265,475**	**263,355**	**253,930**	**1,094,477**

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Employment Compensation Impacts

Category	Years 1–10	Years 10–20	Years 20–30	Years 30–40	Years 40–50	Total over 50 Years
CM1 Water Facilities and Operation						
Construction and planning	$7,791	$0	$0	$0	$0	$7,791
Operations and maintenance	$0	$188	$140	$104	$78	$510
Total	**$7,791**	**$188**	**$140**	**$104**	**$78**	**$8,301**
Other Relevant Conservation Measures (CM2–CM11, CM13–CM21)						
Construction and planning	$923	$489	$366	$256	$49	$2,084
Operations and maintenance	$192	$204	$140	$109	$84	$728
Land acquisition[b]	$103	$64	$44	$33	$0	$245
Other[c]	$149	$130	$89	$68	$45	$482
Agricultural land retirement[d]	($92)	($169)	($194)	($196)	($156)	($807)
Total	**$1,275**	**$718**	**$446**	**$270**	**$22**	**$2,732**
Total Employment Impacts Across All Categories (except water reliability)						
Total	**$9,066**	**$907**	**$586**	**$375**	**$99**	**$11,033**